BORON DOPED NANOCRYSTALLINE DIAMOND FILMS

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Abstract

Nanocrystalline diamond films are of particular interest for the development of Micro/Nano-Electromechanical Systems (MEMS/NEMS), microfluidics, SAW devices, electrochemical electrodes, low friction tribological coatings etc where the high roughness of thick polycrystalline material or high cost of polished/single crystal diamond may be undesirable. In order to be useful for many of the applications listed above however, it is necessary to be able to control the conductivity of this material from near intrinsic to semi-metallic.

This work describes the current status of Boron Doping of nanocrystalline diamond films at the Institute for Materials Research, Diepenbeek, Belgium. Highly uniform nanocrystalline diamond films have been grown in an Astex 6500 15kW Microwave Plasma System over a wide range of conditions. The effect of the addition of Trimethylboron into the gas phase on the electronic properties of these films has been characterised by photothermal deflection spectroscopy (PDS), FTIR, Scanning Tunnelling Microscopy (STM), Atomic Force Microscopy (AFM) and low temperature Hall effect / conductivity measurements. Scanning Electron Microscopy has been utilised to characterise morphology, growth rate and alpha parameter as a function of temperature and trimethylboron concentration in the gas phase. Optical emission spectroscopy and interferometry were used *in-situ* to characterise the growth process.

These films show conductivity behaviour ranging from insulating to semi-metallic conductivity with increasing trimethylboron concentration in the gas phase. These films have been used for electrochemical studies. Procedures for enhancing the nucleation density of these films will be discussed.

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